North Coast Watershed Assessment Program

Gualala Watershed Synthesis Report

The mission of the North Coast Watershed Assessment Program is to conserve and improve California's north coast anadromous salmonid populations by conducting, in cooperation with public and private landowners, systematic multi-scale assessments of watershed conditions to determine factors affecting salmonid production and recommend measures for watershed improvements.

DRAFT

Program Introduction and Overview

North Coast Watershed Assessment Program (NCWAP)

Salmon / Stream / Watershed / Land Use Relationships

Anadromous Pacific salmonids are dependant upon a high quality freshwater environment at the beginning and end of their life cycles. As such, they thrive or perish depending upon the availability of cool, clean water, free access to migrate up and down their natal streams, clean gravel for successful spawning, adequate food supply, and protective cover to escape predators and ambush prey. These life requirements must be provided by diverse and complex instream habitats as the fish move through their life cycles. If any of these elements are missing or in poor condition at the time a fish or stock requires it, their survival can be impacted. These life requirement conditions can be identified and evaluated on a spatial and temporal basis at the stream reach and watershed levels. They comprise the factors that support or limit salmonid stock production.

"In streams where fish live and reproduce, all the important factors are in a suitable (but usually not optimum) range throughout the life of the fish. The mix of environmental factors in any stream sets the carrying capacity of that stream for fish, and the capacity can be changed if one or more of the factors are altered. The importance of specific factors in setting carrying capacity may change with life stage of the fish and season of the year," (Bjorrn and Reiser, 1991).

Through the course of the years, natural climatic, watershed hydrologic responses, and erosion events interact to shape freshwater salmonid habitats. These include the kind and extent of the watershed's vegetative cover as well, and act to supply nutrients to the stream system. "In the absence of major disturbance, these processes produce small, but virtually continuous changes in variability and diversity against which the manager must judge the modifications produced by nature and human activity. Major disruption of these interactions can drastically alter habitat conditions." (Swanston, 1991).

The results of a major disruption, which can be created over time by many smaller disruptions, can drastically alter instream habitat conditions and the aquatic communities that depend upon them. Thus, it is important to understand the critical, dependent relationships of salmon and steelhead with their natal streams during their freshwater life phases, and their streams' dependency upon the watersheds within which they are nested, and the energy of the watershed processes that binds them together.

"Protection and maintenance of high-quality fish habitats should be among the goals of all resource managers. Preservation of good existing habitats should have high priority, but many streams have been damaged and must be repaired. Catastrophic natural processes that occlude spawning gravels can reduce stream productivity or block access by fish (for example), but many stream problems, especially in western North America, have been caused by poor resource management practices of the past. Enough now is known about the habitat requirements of salmonids and about good management practices that further habitat degradation can be prevented, and habitat rehabilitation and enhancement programs can go forward successfully," (Meehan, 1991).

In general, natural disruption regimes do not impact larger watersheds, like the 300 square mile Mattole, in their entirety at any given time. Rather, they rotate episodically across the entire mosaic of their smaller subbasin, watershed, and sub-watershed components over long periods of time. This creates a shifting mosaic of habitat conditions over the larger watershed, (Reice, 1994).

Human disturbances, although individually small in comparison to natural events, are usually spatially distributed widely across basin level watersheds (Table 1), (Reeves, et al., 1995). That occurs because market driven land uses tend to function in temporal waves, like the California Gold Rush or the post-WWII logging boom in Northern California. The intense human land use of the last century, combined with the energy of two mid-century, record floods on the North Coast, created stream habitat impacts at the basin and regional scales. The result has overlain the natural disturbance regime and depressed stream habitat conditions across most of the North Coast region.

TABLE 1: WATERSHED DISTURBANCE REGIMES (REEVES, 2001)

	Natural Disturbance	Anthropogenic Disturbance
Magnitude	High	Low, Medium
Frequency	Low	High
Area Affected	Small to Intermediate	Large
Coupling of System	Maintains	Decouples
Legacy	Wood, Sediment	Sediment

No long term fish counts exist for the Gualala River. However, the information, although of differing quantity and quality reflects the absence of coho in all subbasins since 1998, with the rate of decline most evident in the late 60's and early 70's. Steelhead also appear to have decline, more in some subbasins than others.

ADD FIGURES OF HISTORIC CREEL CENSUS

ADD E-FISHING GRAPHIC

Factors Affecting Anadromous Salmonid Production

Coho salmon and steelhead trout all utilize headwater streams, larger rivers, estuaries and the ocean for parts of their life history cycles. There are several factors necessary for the successful completion of an anadromous salmonid life history.

A main component of the NCWAP is the analyses of these factors in order to identify whether any of them are at a level that limits production of anadromous salmonids in North Coast watersheds. This "limiting factors analysis" (LFA) provides a means to evaluate the status of a suite of key environmental factors that affect anadromous salmonid life history.[1] These analyses are based on comparing measures of habitat components such as water temperature and pool complexity to a range of reference conditions determined from empirical studies and/or peer reviewed literature. If the component's condition does not fit within the range of the reference values, it may be viewed as a limiting factor. This information will be useful to identify the underlying causes of stream habitat deficiencies and help reveal if there is a linkage to watershed processes and land use activities.

In the freshwater phase in salmonid life history, stream connectivity, stream condition, and riparian function are essential for survival. Stream connectivity describes the absence of barriers to the free instream movement of adult and juvenile salmonids. Free movement in well-connected streams allows salmonids to find food, escape from high water temperatures, escape from predation, and migrate to and from their stream of origin as juveniles and adults. Dry or intermittent channels can impede free passage for salmonids; temporary or permanent dams, poorly constructed road crossings, landslides, debris jams, or other natural and/or man-caused channel disturbances can also disrupt stream connectivity.

The concept that fish production is limited by a single factor or by interactions between discrete factors is fundamental to stream habitat management (Meehan 1991). A limiting factor can be anything that constrains, impedes, or limits the growth and survival of a population.

Stream condition includes several factors. They include adequate stream flow, suitable water quality, suitable steam temperature, and complex habitat. For successful salmonid production, stream flows should mimic the natural hydrologic regime of the watershed. A natural regime minimizes the frequency and magnitude of storm flows and promotes better flows during dry periods of the water year. Salmonids evolved with the natural hydrograph of coastal watersheds, and changes to the timing, magnitude, and duration of low flows and storm flows can disrupt the ability of fish to follow life history cues. Adequate instream flow during low flow periods is essential for good summer time stream connectivity, and is necessary to provide juvenile salmonids free forage range, cover from predation, and utilization of localized temperature refugia from seeps, springs, and cool tributaries.

Three important aspects of water quality for anadromous salmonids are water temperature, turbidity, and sediment load. In general, suitable water temperatures for salmonids are between 48° and 56° F for successful spawning and incubation, and between 50-52° and 60-64° F, depending on species, for growth and rearing. Additionally, cool water holds more oxygen, and salmonids require high levels of dissolved oxygen in all stages of their life cycle.

A second important aspect of water quality is turbidity, which is the relative clarity of water. Water clarity and turbid suspended sediment levels affect nutrient levels in streams that in turn affect primary productivity of aquatic vegetation, and insect life. This eventually reverberates through the food chain and affects salmonid food availability. Additionally, high levels of turbidity interfere with juvenile salmonids' ability to feed and can lead to reduced growth rates and survival (B. Trush, personal communication).

A third important aspect of water quality is stream sediment load. Salmonids cannot successfully reproduce when forced to spawn in streambeds with excessive silt, clays, and other fine sediment. Eggs and embryos suffocate under excessive fine sediment conditions because oxygenated water is prevented from passing through the egg nest, or "redd." Additionally, high sediment loads can "cap" the redd and prevent emergent fry from escaping the gravel into the stream at the end of incubation. High sediment loads can also cause abrasions on fish gills, which may be susceptible to infection. At extreme levels, sediment can clog the gills causing death. Additionally, materials toxic to salmonids can cling to sediment and be transported through the downstream areas.

Habitat complexity for salmonids is created by a combination of deep pools, riffles, and flatwater habitat types. Pools, and to some degree flatwater habitats, provide escape cover from high velocity flows, hiding areas from predators, and ambush sites for taking prey. Pools are also important juvenile rearing areas, particularly for young coho salmon. They are also necessary for adult resting areas. A high level of fine sediment fills pools and flatwater habitats. This reduces depths and can bury complex niches created by large substrate and woody debris. Riffles provide clean spawning gravels and oxygenate water as it tumbles across them. Steelhead fry use riffles during rearing. Flatwater areas often provide spatially divided "pocket water" units that separate individual juveniles which helps promote reduced competition and successful foraging (Flosi, et al., 1998).

A functional riparian zone helps to control the amount of sunlight reaching the stream, and provides vegetative litter and invertebrate fall. These contribute to the production of food for the aquatic community, including salmonids. Tree roots and other vegetative cover provide stream bank cohesion and buffer impacts from adjacent uplands. Nearstream vegetation eventually provides large woody debris and complexity to the stream (Flosi et al. 1998).

Riparian zone functions are important to anadromous salmonids for numerous reasons. Riparian vegetation helps keep stream temperatures in the range that is suitable for salmonids by maintaining cool stream temperatures in the summer and insulating streams from heat loss in the winter. Larval and adult macroinvertebrates are important to the salmonid diet and they are in turn dependant upon nutrient contributions from the riparian zone. Additionally, stream bank cohesion and maintenance of undercut banks provided by riparian zones in good condition maintains diverse salmonid habitat, and helps reduce bank failure and fine sediment yield to the stream. Lastly, the large woody debris provided by riparian zones shapes channel morphology, helps a stream retain organic matter and provides essential cover for salmonids (Murphy and Meehan 1991).

Therefore, excessive natural or man-caused disturbances to the riparian zone, as well as the directly to the stream and/or the watershed itself can have serious impacts to the aquatic community, including anadromous salmonids. Generally, this seems to the case in streams and watersheds in the north coast of California. This is borne out by the recent decision to include many North Coast chinook and coho salmon, and steelhead trout stocks on the Endangered Species Act list.

Policies, Acts, and Listings

Several federal and state statues have significant implications for watersheds, streams, fisheries, and their management. Here, we present only a very brief listing and description of several laws.

Federal Statutes

One of the most fundamental of federal environmental statutes is the **National Environmental Policy Act** (NEPA). NEPA is essentially an environmental impact assessment and disclosure law. Projects contemplated or plans prepared by federal agencies or funded by them must have an environmental assessment completed and released for public review and comment, including the consideration of more than one alternative. The law does not require that least impacting alternative be chosen, only that the impacts be disclosed.

The federal **Clean Water Act** has a number of sections relevant for watersheds and water quality. Section 208 deals with non-point source pollutants arising from silvicultural activities, including cumulative impacts. Section 303 deals with waterbodies that are impaired such that their water quality is not suitable for the beneficial uses identified for those waters. For water bodies identified as impaired, the US Environmental Protection Agency or its state counterpart (here, the North Coast Regional Water Quality Control Board and the State Water Resources Control Board) must set targets for "total maximum daily loads" (TMDLS) of the pollutants that are causing the impairment. Section 404 deals with the alterations of wetlands and streams through filling or other modifications, and requires the issuance of federal permits for most such activities.

The federal **Endangered Species Act of 1973** (FESA) addresses the protection of animal species whose populations are dwindling to critical levels. Two levels of species risk are defined. "Threatened" means any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. "Endangered" species means any species that is in danger of extinction throughout all or a significant portion of its range. In general, the law forbids the "take" of listed species. Where specially permitted through the completion and approval of a habitat conservation plan, take of a species listed as threatened may be allowed. Many of California's salmon runs are listed under FESA, including Mattole River chinook and coho salmon, and steelhead trout, which have been proposed for listing.

State Statutes

The state analogue of NEPA is the **California Environmental Quality Act** (CEQA). CEQA goes beyond NEPA in that is requires the project or plan proponent to select for implementation the least environmentally impacting alternative considered. When the least impacting alternative would still cause "significant" adverse environmental impacts, a statement of overriding considerations must be prepared.

The Porter-Cologne Water Quality Control Act establishes state water quality law and defines how the state will implement the federal authorities that have been delegated to it by the US EPA under the federal Clean Water Act. For example, the US EPA has delegated to the state certain authorities and responsibilities to implement TMDLS for impaired water bodies and NPDES (national pollution discharge elimination system) permits to point-source dischargers to water bodies.

Sections 1600 et seq. of the Fish and Game Code, implemented by the Department of Fish and Game, are required for any activities that alter the beds or banks of streams or lakes. While treated as ministerial in the past, the courts have more recently indicated that these constitute discretionary permits and thus must be accompanied by an environmental impact review per CEQA.

The **California Endangered Species** Act (CESA) … The California Endangered Species Act (CESA) (Fish & Game Code §§ 2050, *et seq.*) generally parallels the main provisions of the Federal Endangered Species Act and is administered by the California Department of Fish and Game (DFG). Coho salmon, found in the Mattole, is currently a candidate for listing under CESA. The State Fish and Game Commission is expected to make the final listing decision of this species in 2002.

The **Z'Berg-Nejedly Forest Practice Act** (FPA) and associated **Forest Practice Rules** establish extensive permitting, review, and management practice requirements for commercial timber harvesting. Evolving in part in response to water quality protection requirements established by the 1972 amendments to the federal Clean Water

Act, the FPA and Rules provide for significant measures to protect watersheds, watershed function, water quality, and fishery habitat.

Assessment Needs for Salmon Recovery and Watershed Protection

The North Coast Watershed Assessment Program (NCWAP) is an interagency effort between the California Resources Agency and CalEPA which was established in 2000 to provide a consistent scientific foundation for collaborative watershed restoration efforts and to better meet the State needs for protecting and restoring salmon species and their habitats under State and federal laws. The program was developed by a team of managers and technical staff from the following departments with watershed responsibilities for the North Coast: California Resources Agency, California Department of Fish and Game (DFG), California Department of Forestry and Fire Protection (CDF), California Department of Conservation/Division of Mines and Geology (DOC/DMG), California Department of Water Resources (DWR), and the North Coast Regional Water Quality Control Board (RWQCB) of the State Water Resources Control Board. The Institute for Fisheries Resources (IFR) is also a partner and participant in this program. The California Resources Agency in coordination with CalEPA, initiated this program in part in response to specific requests from landowners and watershed groups that the State take a leadership role in conducting scientifically credible, interdisciplinary assessments that could be used for multiple purposes. The need for comprehensive watershed information grew in importance with listings of salmonids as threatened species, the TMDL (total maximum daily load) consent decree, and the increased availability of assistance grants for protecting and restoring watersheds.

Listings under the federal Endangered Species Act for areas within the NCWAP region (the North Coast Hydrologic Unit) began with coho salmon in 1966, followed by Chinook salmon in 1999, and steelhead in 2000. In 2001, coho was proposed for listing under the California Endangered Species Act. Concerns about the potential impacts of salmonid listings and Total Maximum Daily Loads (TMDL) on the economy are particularly strong on the North Coast where natural-resource-dependent industries predominate. Cumulative impacts related to these activities, along with natural processes, can adversely affect watershed conditions and fish habitat, including landslides, flooding, timber harvest, mining, ranching, agricultural uses and development. In order to recover California's salmonid fisheries, it is necessary to first assess and understand the linkages among management activities, dominant ecological processes and functions, and factors limiting populations and their habitat.

NCWAP integrates and augments existing watershed assessment programs to conform with proven methodologies and manuals available from each department. The program also responds to recommendations from a Scientific Review Panel (SRP) which was created under the auspices of the State's Watershed Protection and Restoration Council as required by the March, 1998 Memorandum of Understanding (MOU) between the National Marine Fisheries Service (NMFS) and the California Resources Agency. The MOU required a comprehensive review of the California Forest Practice Rules (FPRs) with regard to their adequacy for the protection of salmonid species. In addition, the promise of significant new State and federal salmon restoration funds highlighted the need for watershed assessments to ensure those dollars are well spent.

NCWAP Program Goals

The NCWAP was developed to improve decision-making by landowners, watershed groups, agencies, and other stakeholders with respect to restoration projects and management practices to protect and improve salmonid habitat. It was therefore essential that the program took steps to ensure its assessment methods and products would be understandable, relevant, and scientifically credible. As a result, the interagency team developed the following goals:

1. Organize and provide existing information and develop limited baseline data to help evaluate the effectiveness of various resource protection programs over time;

2. Provide assessment information to help focus watershed improvement programs, and assist landowners, local watershed groups, and individuals to develop successful projects. This will help guide support programs, like DFG's Fishery Restoration Grants Program, toward those watersheds and project types that can efficiently and effectively improve freshwater habitat and lead to improved salmonid populations;

3. Provide assessment information to help focus cooperative interagency, nonprofit and private sector approaches to "protect the best" watersheds and streams through watershed stewardship, conservation easements, and other incentive programs; and

4. Provide assessment information to help landowners and agencies better implement laws that require specific assessments such as the State Forest Practice Act, Clean Water Act, and State Lake and Streambed Alteration Agreements.

Program Objectives and Guiding Questions

During the assessment process, the NCWAP agencies will work together very closely at all stages to consider how man-caused and naturally occurring watershed processes interact and affect stream conditions for fisheries, and other uses, and also consider the implications for watershed management.

During the formulation of the NCWAP's Methods Manual, the participating agencies agreed upon a short list of critical questions with the key question being:

"What watershed factors are limiting salmonid populations?"

- What are the general relationships between natural event and land use histories, for example, fire, flood, drought, earthquake, etc.; and urban and rural land development, timber harvest, agriculture, roads, dams, and stream diversions. How is this history reflected in the current vegetation and level of disturbance in North Coast watersheds? How can these kinds of disturbances be meaningfully quantified?

- What is the spatial and temporal distribution of sediment delivery to streams from landsliding, bank, sheet and rill erosion, and other erosion mechanisms, and what are the relative quantities for each source?

- What are the effects of stream, spring, and groundwater uses on water quality and quantity?

- What role does large woody debris (LWD) have within the watershed in forming fish habitat and determining channel condition and sediment routing and storage?

- What are the current salmonid habitat conditions in the watershed, the aquatic/riparian zone, and the estuary (flow, water temperature/shade, sediment, nutrients, instream habitat, large woody debris and its recruitment); how do these compare to desired conditions (life history requirements of salmon, Basin Plan water quality objectives)?

- What are the history and trends of the sizes, distribution, and relative health and diversity of salmonid populations and/or other aquatic community organisms within the watersheds?

- Does the status of these populations reflect current watershed and stream habitat conditions or does it indicate constraints beyond the watershed might exist. For example, a lack of stream connectivity that prevents free movement for adults or juveniles, or a poor marine life history, could affect a salmonid population.

These questions have guided the individual team members in data gathering and procedure assessment. The questions have provided direction for those analyses that required more interagency, interdisciplinary synthesis, including the analysis of factors affecting anadromous salmonid production.

Program Assessment Region and Agency Roles

The NCWAP assessment area includes all coastal drainages from Sonoma County north to Oregon. This area corresponds with the North Coast Water Quality Control Board's region. The region has been sub-divided into thirty-one basins for NCWAP assessment purposes (Map XX). Thus, the program will organize existing information and provide limited baseline environmental and biological information for approximately 6.5 million acres of land over an estimated seven-year period. The administrative lead for the NCWAP is the California Resources Agency

The roles of the five participating agencies in these efforts are as follows:

- DFG will compile, develop, and analyze data related to anadromous fisheries habitat and populations. It will also lead an interagency evaluation of factors affecting anadromous fisheries production at the watershed level and provide recommendations for restoration and monitoring in the final synthesis report.

- CDF will compile, develop, and analyze data related to historical land use changes in the watersheds. It will also take the lead on preparing reports that synthesize information, findings and recommendations, and develop a framework for assessing cumulative impacts.

- DOC/DMG will compile, develop, and analyze data related to the production and transport of sediment. Tasks will include baseline mapping of landslides, landslide potential, and instream sediment, as well as an analysis of stream geomorphology and sediment transport.

- RWQCB will compile, collect, and analyze water quality data for the assessments.

- DWR will install and maintain stream monitoring gages where needed to develop and analyze stream flow information.

Assessment Strategy and General Methods

Because the NCWAP is intended to provide information useful for several purposes, its approach emphasizes close coordination with clientele groups. The NCWAP products are expected to provide both context and content for finer scale analysis, set priorities for detailed analysis and program planning, and identify areas for further work. Therefore, although a relatively uniform assessment process will be followed in each basin, key issues and information are custom to each watershed. Variability in watershed condition, public resource values and concerns, land use and ownership, and the availability of existing data shape each assessment within the context of the guiding, critical questions. Public review of products will provide additional opportunities to adapt and enhance assessments in the future.

The steps of the NCWAP process in each basin are:

Step One: Scoping. The basin assessment team will meet with stakeholders to identify watershed problems or concerns, local assessment interests, existing data and gaps, and opportunities to work with local interests to answer the critical questions.

Step Two: Data compilation. The team will compile and screen existing data according to the quality and usefulness for answering critical questions and application to the program's Ecological Management Decision Support system model (EMDS). This model accepts information about the study watershed and /or stream, and helps process and explains relationships among current conditions affecting fishery production. Quality control processes are described in greater detail in Chapter 4 of the NCWAP's draft Method Manual. Mapping and geographical information system (GIS) presentation will be coordinated among the several departments.

Step Three: Initial Analyses. The team will use the EMDS model (described in Chapter 3 of the NCWAP's Methods Manual) to help analyze the habitat factors affecting fish production. This initial model run with existing data will help to identify significant data gaps (categories, location, and scale) and to focus field data verification and collection by DFG and others. The model will be updated as run as new data is collected and/or developed.

Step Four: Fieldwork. Agencies will conduct necessary fieldwork, including validation of existing data, verification of imagery or photo-based analyses, and collection of new data to fill critical gaps. Throughout this process, there will be coordination with local groups and landowners on access to private property and validation of findings.

Step Five: Analyze data. This includes the generation of maps, databases, and the more integrative analyses. Data will be analyzed in an interdisciplinary fashion where needed, particularly when answering critical questions, applying the limiting factors analysis, and developing general management and cumulative efforts recommendations.

Step Six: Develop Assessment Reports for Public Review: Draft products will include data developed or compiled by all the agencies as licenses or agreements permit (including photos and imagery); analytical products such as maps, limiting factor analysis results, GIS analyses, topical reports, etc.; and the review summary report with recommendations. These products will be made available in hard copy from NCWAP offices in Fortuna, Santa Rosa, and Sacramento; and also through the Klamath Resources Information System CD and on-line. A public review process will be established for each basin. The NCWAP team will summarize comments and revise preliminary products to reflect comments as feasible.

NCWAP Products

The NCWAP will produce and make available to the public a consistent set of products for each basin assessed. They include the following:

- Databases of information that the NCWAP has used and collected for its analysis. The NCWAP will also provide a data catalogue which identifies all the information we considered, and evaluates its usefulness for the NCWAP assessment process, as well as a bibliography of other references cited in the assessment report.

- Maps showing geology, geomorphic features related to landsliding, instream sediment and transport zones, and relative landslide potential developed by the Department of Conservation/Division of Mines and Geology.

- An Ecological Management Decision Support system (EMDS) model that describes how watershed conditions interact at the stream reach and watershed scale to affect suitability for fish.

- GIS-based models and analyses such as timber harvest frequency, road-based erosion model runs, vegetation, stream buffers, roads, road density, road and stream interactions, and roads on unstable slopes.

- An interdisciplinary analysis of the results of fieldwork, historical analyses, EMDS data, and other analytical products about the suitability of stream reaches and the watershed for salmonids.

- An interagency description of historic and current conditions as they relate to suitability for salmonid fisheries. This will address vegetation cover and change, land use, geology and geomorphology, water quality, streamflow and water use, and instream habitat conditions for salmonids. It will also contain hypotheses about watershed conditions that contribute to factors affecting salmonids.

- Recommendations for management and restoration to address limiting factors.

- Recommendations for additional monitoring to improve the assessment process.

- A CD developed through the Institute for Fisheries Resources (IFR) which uses the Klamath Resources Information System (KRIS) tool to store data, provide a regional bibliography of watershed studies and reports, present the NCWAP analyses, maps and other products, and store community based data over time.

- A synthesis report describing the results and implication of the watershed assessment.

All products will be made available electronically through the NCWAP website and the IFR's KRIS tool on CD and on their website.

Assessment Report Conventions and Use

Calwater 2.2a Planning Watersheds

NCWAP is using the California Watershed Map (CALWATER version 2.2a) to delineate watershed units. CALWATER is a set of standardized watershed boundaries meeting standardized delineation criteria. The hierarchy of watershed designations consists of six levels of increasing specificity: Hydrologic Region (HR), Hydrologic Unit (HU), Hydrologic Area (HA), Hydrologic Sub-Area (HSA), Super Planning Watershed (SPWS), and Planning Watershed (PWS). The primary purpose of Calwater is the assignment of a single, unique code to a specific watershed polygon. The Calwater Planning Watersheds are generally from 3,000 – 10,000 acres in size.

Primary purposes for Calwater 2.2 include but are not limited to mapping, reporting, and statistical analysis of water resources, water supply, water quality, wildlands, agriculture, soils, forests, rangelands, fish habitat, wildlife habitat, cross-referencing state and federal hydrologic unit or watershed codes and names.

CALWATER version 2.2 is the third version of Calwater (after versions 1.2 and 2.0), and is a descendent of the 1:500,000-scale State Water Resources Control Board Basin Plan Maps drawn in the late 1970's.

Tierra Data Systems completed Version 1.2 in 1995 by Tierra Data Systems (Jim Kellog). Line work was captured by overlaying the Basin Plan Maps on 1:24,000-scale USGS quad sheets, redrawing and digitizing lines to match 1:24,000-scale watershed boundaries, and subdividing the 4th level Hydrologic Subareas (HSA's) into 5th level Super Planning Watersheds (SPWS) and 6th level Planning Watersheds (PWS).

Hydrology Hierarchy

Watershed terminology often becomes confusing when discussing the different scales of watersheds involved in planning and assessment activities. The conventions used in the Mattole assessment follow the guidelines established by the Pacific Rivers Council. The descending order of scale is from ***basin*** level (e.g., Mattole Basin) – ***subbasin*** level (e.g., Northern subbasin) – ***watershed*** level (e.g., Honeydew Creek) – ***sub-watershed*** level (e.g., West Fork Honeydew Creek).

The subbasin is the assessment and planning scale used in this report as a summary framework; subbasin findings and recommendations are based upon the more specific watershed and sub-watershed level findings. Therefore, there are usually exceptions at the finer scales to subbasin findings and recommendations. Thus, the findings and recommendations at the subbasin level are somewhat more generalized than at the watershed and sub-watershed scales. In like manner, subbasin findings and recommendations are somewhat more specific than the even more generalized, larger scale basin level findings and recommendations that are based upon a group of subbasins.

The term "watershed" is used in both the generic sense, as to describe "watershed" conditions at any scale, and as a particular term to describe the ***watershed*** scale introduced above, which contains, and is made up from multiple, smaller sub-watersheds. The watershed scale is often approximately 20 – 40 square miles in area; its sub-watersheds can be much smaller in area, but for our purposes contain at least one perennial, un-branched stream. Please be aware of this multiple usage of the term watershed, and consider the context of the term's usage to reduce confusion.